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Killing Oak Brush a Tricky Business

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KENNETH A. BRINKMAN began his career in forest research at the Central States Station 20 years ago. His first stay was short, however, because he soon moved to Mississippi with the Southern Forest Experiment Station, then to Arizona with the Southwestern Station, then to Alabama with the Southern Station again. Finally, in 1948, he returned to the Central States and worked in Iowa until 1955. Since then he has been at our Columbia, Missouri, Research Center. A lieutenant in the Coast Guard during World War II, Brinkman was commanding officer of a subchaser and later a tanker. Ken got his forestry training in his native state of Iowa, earning B.S. and M.S. degrees at Iowa State University. He is a silviculturist specializing in regeneration, woody-plant control, and conversion of low-quality oak stands. This is his 10th technical publication.

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Killing Oak Brush a Tricky Business

By

Kenneth A. Brinkman

All oak species are not equally susceptible to foliage sprays of the same herbicide, and some are difficult to kill with any herbicide. Even recommended concentrations and techniques often give poor results. A recent study indicates that several things may be responsible for inconsistent kills.

Various concentrations of four herbicides were tested as sprays for killing sprout reproduction in the Missouri Ozarks. Results varied greatly even under carefully controlled conditions, indicating that the use of these herbicides was not quite as simple or foolproof as is commonly believed. Good control of a particular species at reasonable cost apparently hinges on using the right herbicide in the right concentration at the right time of year.

WHAT WAS DONE?

The effectiveness of 33 herbicide treatments for killing oak reproduction was tested in a natural stand consisting of some 4,000 three-year-old sprouts per acre with a few larger trees (fig. 1). The overstory trees were killed before the study began. The reproduction was nearly all less than 6 feet tall, and mostly blackjack oak. Black, post, white, and scarlet oaks also were present in that order of abundance.

Herbicides included ammate, 2,4-D, 2,4,5-T, and monuron (CMU) in different concentrations (table 1, p. 6). The sprays were applied in June, August, and September of 1952, a dry year. Enough herbicide was sprayed on the foliage and stems to thoroughly wet the surfaces.

Annual examinations were made to determine treatment effects. Trees were classed as "killed" only when the tops were dead and there were no living sprouts. Mortality due to treatment was virtually complete at the end of 3 years.

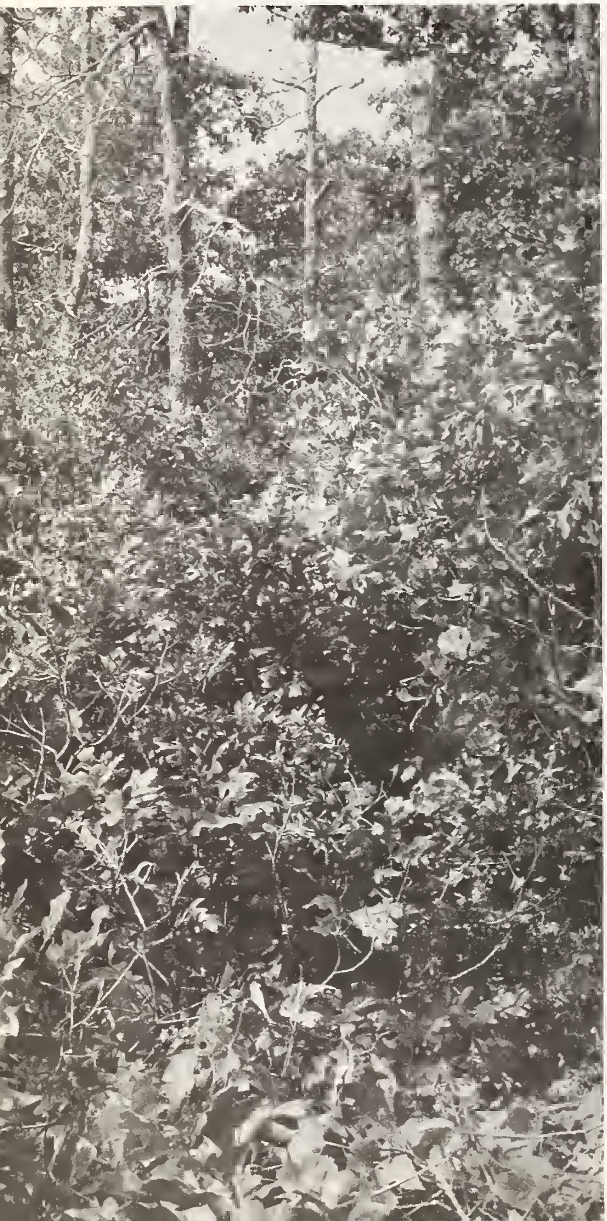

Figure 1. -Oak brush on land cleared for grazing.

WHAT WAS LEARNED?

Herbicide treatments ranged from completely effective to nearly useless. Monuron gave consistently good kills, but 2,4-D and ammate sometimes were not much better than no treatment at all. The "best" treatment differed for each species or species group, particularly when costs of materials were considered.

In the concentrations tested, monuron killed nearly all oak reproduction regardless of species or month of application. This chemical is a soil sterilant: Many of the treated areas remained devoid of plant cover of any kind for 6 or 7 years. Although more dilute solutions of monuron might have been equally effective, none were tested. Materials for the cheapest concentration used cost about $190 per acre (table 1). Because of this, monuron is not considered practical at present for use as a foliage spray in the concentrations tested and will not be discussed further.

The effectiveness of the other sprays depended both on the species of oak and the month of application. To avoid unnecessary repetition, results will be discussed by species or species group.

Blackjack Oak

The leathery leaves of this species and its persistent sprouting habit make it difficult to control with herbicides. The 4-pound-per-gallon concentration of ammate killed about 82 percent of the trees when applied in June (table 2, p. 7). Because this treatment cost about $88 per acre, however, one of the next-best treatments is a more logical choice. The 4-pound a.h.g. emulsion of 2,4,5-T killed as many trees as the 2-pound-per-gallon solution of ammate, and cost less than half as much. There were no significant differences in the effectiveness of the next seven treatments listed. The relatively good kill with 2,4-D in June might make this inexpensive treatment attractive where only blackjack oaks are to be killed.

Post Oak and White Oak

About 90 percent of the trees of these species were killed by 2,4,5-T as either 4- or 8-pounds a.h.g. in water applied in June (table 3, p. 8). The 4-pound concentration was cheaper and thus more practical. The eight next-best treatments killed about 74 percent of the trees. Application in June usually was better than in other months.

Black Oak and Scarlet Oak

The apparently scrambled order of treatment effectiveness on these species is not unusual (table 4, p. 9). About 87 percent of the trees were killed with 2,4,5-T either as a 4-pound a.h.g. emulsion in September or as 8-pound a.h.g. in water in June. Although the two treatments were equally effective, the first cost much less than the second. There is no obvious reason why the emulsion killed fewer trees earlier in the season unless the oil "burned" the foliage and thus reduced translocation and herbicide effect. Of the nine next-best treatments, both concentrations of 2,4-D were cheaper than the others and equally effective on these species.

WHAT DOES IT MEAN?

In general, white and post oaks were easier to kill than black and scarlet oaks. Blackjack oak was most resistant to herbicides. June spraying usually gave the best results, perhaps because translocation is occurring at this time and the herbicide may be absorbed and moved to the root system before it is washed off by rain. Most September sprays gave poor kills because absorption was inhibited by a waxy cuticle on the oak leaves, and translocation was reduced. During a wet summer translocation may continue until fall, thus prolonging the period when herbicides would be effective.

For killing the oak species tested, 2,4,5-T was much more efficient in an emulsion than when used in water alone. The small amount of fuel oil in the emulsion apparently was adequate to penetrate the cuticle of the leaves, facilitating absorption and translocation. So by using an emulsion, $1 worth of diesel fuel can take the place of $4 worth of 2,4,5-T. This preparation gave consistently good kills when applied in June or August.

Results of this study probably raise more questions than they answer, but they illustrate some of the important things to consider in selecting a herbicide. Because few herbicide treatments kill all trees in one application, a second usually will be needed. The most effective treatment thus may not be the "best buy". The lowest total cost for controlling oak reproduction may result from using a spray giving 70 percent or better kill at reasonable cost with provision for following up with a second application.

The importance of seemingly minor factors in influencing the final results of treatment points to the need for careful evaluation of each brush control problem. This requires matching herbicide, concentration, and month of application to the species or species group involved, with overall cost and efficiency determining the exact treatment to be used.

TABLES

Table 1.--Herbicides and concentrations tested, and cost [1]

Herbicide	Concentration and carrier	Approximate Cost: Per gallon	Approximate Cost: Per acre
		(Dollars)	
2,4-D	4# a.h.g. in water[2]	0.035	3.85
2,4-D	8# a.h.g. in water	.07	7.70
2,4,5-T	4# a.h.g. in water	.08	8.50
2,4,5-T	4# a.h.g. emulsion (1 part #1 fuel oil to 5 parts water)	.084	9.00
2,4,5-T	8# a.h.g. in water	.16	17.00
Ammate	1# per gal. water	.20	22.00
Ammate	2# per gal. water	.40	44.00
Ammate	4# per gal. water	.80	88.00
Monuron	1/2# per gal. water	1.75	190.00
Monuron	1# per gal. water	3.50	380.00
Monuron	2# per gal. water	7.00	760.00

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[1] Based on the following costs for chemicals and materials:

2,4-D (Esteron 10-10) 4# acid equivalent conc. @ $3.50/gal.
2,4,5-T (Esteron 245) 4# acid equivalent conc. @ 8.00/gal.
Ammate 80% ammonium sulphamate @ 0.20/pound
Monuron 80% active ingredients @ 3.50/pound
#1 diesel fuel @ 0.16/gal.

The more expensive concentrations were included because of interest in finding a sure way to isolate trees infected with oak wilt.

[2] A.h.g. means acid equivalent per hundred gallons of spray.

Table 2.--Kill of blackjack oaks by separate treatments, and by clusters of treatments giving equally good results (0.95 probability)

Herbicide	Concentration	Month applied	Trees killed: Separate treatments	Trees killed: Cluster of treatments
			(Percent)	(Percent)
Ammate	4# per gallon	June	82	82
Ammate	2# per gallon	June	67	67
2,4,5-T	4# emulsion	June	67	
2,4,5-T	4# emulsion	August	58	53
2,4-D	8# a.h.g.	August	54	
2,4-D	4# a.h.g.	June	54	
2,4-D	8# a.h.g.	June	52	
2,4,5-T	8# a.h.g.	August	51	
2,4,5-T	8# a.h.g.	Sept.	51	
Ammate	1# per gallon	June	50	
2,4-D	4# a.h.g.	Sept.	48	43
Ammate	2# per gallon	August	48	
Ammate	2# per gallon	Sept.	46	
2,4-D	4# a.h.g.	August	45	
2,4,5-T	8# a.h.g.	Sept.	43	
Ammate	4# per gallon	Sept.	42	
Ammate	4# per gallon	August	39	
2,4,5-T	4# emulsion	Sept.	38	
Ammate	1# per gallon	Sept.	36	34
2,4,5-T	4# a.h.g.	June	36	
2,4,5-T	4# a.h.g.	August	36	
2,4,5-T	4# a.h.g.	Sept.	31	
2,4-D	8# a.h.g.	Sept.	31	
Ammate	1# per gallon	August	22	22

Table 3.--Kill of post and white oaks by separate treatments, and by clusters of treatments giving equally good results (0.95 probability)

Herbicide	Concentration	Month applied	Trees killed	
			Separate treatments	Cluster of treatments
			(Percent)	(Percent)
2,4,5-T	8# a.h.g.	June	92	90
2,4,5-T	4# a.h.g.	June	88	
Ammate	4# per gallon	June	80	74
Ammate	2# per gallon	June	77	
Ammate	1# per gallon	August	75	
2,4,5-T	8# a.h.g.	Sept.	74	
2,4,5-T	4# emulsion	Sept.	73	
2,4,5-T	4# emulsion	June	72	
2,4,5-T	4# emulsion	August	70	
Ammate	2# per gallon	August	67	
2,4,5-T	4# a.h.g.	Sept.	64	54
2,4-D	4# a.h.g.	June	64	
2,4-D	8# a.h.g.	June	61	
2,4-D	4# a.h.g.	August	60	
Ammate	1# per gallon	Sept.	60	
Ammate	2# per gallon	Sept.	55	
2,4-D	8# a.h.g.	Sept.	53	
2,4-D	8# a.h.g.	August	52	
Ammate	4# per gallon	Sept.	50	
2,4,5-T	8# a.h.g.	August	46	
Ammate	4# per gallon	August	45	
2,4-D	4# a.h.g.	Sept.	44	
Ammate	1# per gallon	June	31	29
2,4,5-T	4# a.h.g.	August	27	

Table 4.--Kill of black and scarlet oaks by separate treatments, and by clusters of treatments giving equally good results (0.95 probability)

Herbicide	Concentration	Month applied	Trees killed	
			Separate treatments	Cluster of treatments
			(Percent)	(Percent)
2,4,5-T	4# emulsion	Sept.	89	87
2,4,5-T	8# a.h.g.	June	85	
2,4-D	8# a.h.g.	June	75	70
Ammate	2# per gallon	June	75	
2,4,5-T	4# emulsion	August	73	
2,4,5-T	4# a.h.g.	June	71	
Ammate	1# per gallon	June	71	
2,4,5-T	8# a.h.g.	Sept.	71	
2,4,5-T	4# emulsion	June	67	
2,4-D	4# a.h.g.	June	65	
Ammate	4# per gallon	June	65	
2,4-D	8# a.h.g.	August	55	53
Ammate	1# per gallon	Sept.	53	
Ammate	1# per gallon	August	50	
2,4,5-T	4# a.h.g.	Sept.	48	
2,4-D	4# a.h.g.	Sept.	45	
2,4-D	8# a.h.g.	Sept.	45	
Ammate	2# per gallon	August	44	
Ammate	4# per gallon	August	33	27
2,4,5-T	8# a.h.g.	August	33	
Ammate	2# per gallon	Sept.	31	
Ammate	4# per gallon	Sept.	23	
2,4,5-T	4# a.h.g.	August	22	
2,4-D	4# a.h.g.	August	20	